

Zinfandel Advocates and Producers

Report
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Project Title: Evaluation of Zinfandel Heritage Selections: Vineyard Data

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Research Objective:

Evaluation of Zinfandel Heritage Selections from a viticultural point of view

Background

In California we are fortunate to have Zinfandel, a grape variety of truly noble stature with no historical reputation to restrict the creativity of California's winegrowers. In California we find the oldest known Zinfandel plantings in the world. Few New World wine regions have had the opportunity to create a great wine completely on their own. With other varieties we constantly compare our efforts to European standards. While the origin of Zinfandel may now be known, the fact remains that with Zinfandel California's winegrowers received a blank canvas with which to create their wines. Zinfandel, therefore, gives us an unparalleled opportunity to create unique world-class wines.

Thanks to the foresight and effort of many people Zinfandel selections from throughout the California were collected and located at the University of California, Davis, Oakville Experimental Vineyard in Oakville, California. The selections were from vineyards at least 60 years old and attention was paid to find vines with small berries and no virus symptoms. This collection is known as the Zinfandel Heritage Vineyard. In addition to obtaining these selections as a historical legacy, our goal is to choose from among them selections that will improve the quality of Zinfandel wines.

Selections have been made from a wide geographic area of the state. We feel that by making selections from throughout the state we will increase the possibility of finding selections that distinguish themselves. At this point the vineyard contains selections from Sonoma, Napa, Mendocino, Contra Costa, San Luis Obispo, San Joaquin, Amador, El Dorado, Alameda, Lake and Santa Clara (Santa Cruz Mountains) counties and the Cucamonga region.

The Zinfandel Heritage Vineyard, located in The Oakville Experimental Vineyard currently consists of 90 selections. Phase I was budded in 1995-6 and consist of 63 selections (this number was reduced to 61 when two selections tested positive for grape fanleaf virus in 1999 and were removed). Phase I includes certified selections of Zinfandel (FPMS 1A, 2 and 3) as well as 3 selections of Primitivo (FPMS 3, 5 and 6). We began budding in Phase II in 1999; there is space for 27 selections. Dr. Carole Meredith has confirmed through DNA analysis that all the selections in Phase I are indeed Zinfandel; Phase II will be analyzed in 2002. The vineyard is planted at 9 ft x 8 ft spacing on a Gravelly Bale Loam. St. George was used as the rootstock and the vines are head-trained and spur pruned. Selections in the vineyard consist of 7 vines without replication. To replicate a collection this large would require much more land than we have available. We are just beginning the evaluation of these selections in a future replicated vineyard.

The planning for this vineyard was done with a strong appreciation that this was both a repository of plant material and a collection of historic material. Therefore, the vineyard was planted in as much of a traditional way as possible. Our use of St. George as the rootstock, nearly square spacing and head-trained spur-pruned vines supported only by split redwood stakes is a design much as you would have seen 100 years ago. One concession to modern viticulture was the installation of a subsurface drip irrigation system.

Virus Status

No evaluation of the Heritage selections can be made while comparing selections of unknown virus status. Relying on visual inspections every effort was made to take selections that were free of virus. We knew, however, that tests would have to be made to confirm the virus status of the selections. Initial steps were taken toward understanding virus status of the selections very early in the history of the Heritage Vineyard.

In 1991 Dr. Deborah Golino and FPMS took 3 selections for woody indexing of virus. In 1997 six more selection went to FPMS for woody indexing. In 1999 all the selections in phase I and II were surveyed for virus using polymerase chain reaction (PCR) at FPMS.

Selections 4, 5 and 6 were indexed beginning in 1991. They were found by woody indexing to be free of virus exclusive of grapevine rupestris stem pitting associated virus (RSP), which two had. This was not surprising since we know that vines grafted on St. George rootstock are almost always infected with RSP. The two selections testing

positive for RSP are now in the process of having the virus removed by shoot tip culture. Tests should be complete this year and results will be reported in next year's report.

Selections 10, 25, 46, 53, 60 and 61 were delivered to FPMS in 1997 for woody indexing. In addition to RSP that 5 selections had, 4 had grapevine leafroll associated virus (GLR) and one tested positive for grapevine fanleaf virus (GFLV). The selection with GFLV was immediately removed from the vineyard. All of these selections, including the GFLV positive selection, are now in the process of having the virus removed by shoot tip culture.

The PCR testing completed in 1999 yielded mixed results, a complete table of results can be found in our report submitted in 2001. After discussion with Dr. Golino we have decided not to consider fleck as a damaging virus and have removed it from consideration. Polymerase chain reaction detection of virus in grapevines is now felt to be more sensitive than traditional woody indexing. For this reason beginning last year all new material coming into FPMS undergoes both PCR and woody indexing. It is important to this project to note that the three selections that underwent woody indexing for virus were all found to be free of GLR. The PCR test however, found all three to be infected with GLR 4,5 complex. From this point forward, we will use PCR as the definitive virus test for this project. Of the viruses tested for GLR was by far the most common with 46% of the selections infected with one or more of the GLR complexes. Interestingly, only one selection that was free of GLR was found to have one of the other viruses. The number of selections testing positive for GLR was not anticipated, teaching us once again that the lack of red leaves in fall is far from being assuring a negative virus status.

Dr. Golino has performed these tests free of charge for the project and we are indebted to her and FPMS for their cooperation and support.

Only selections that are free of virus (not including Fleck or RSP) will be considered for a replicated trial of these selections and further data collected will be presented indicating virus status.

Viticultural Data

In 1998 we began viticultural evaluations of the selections in Phase 1. These measurements are taken at harvest and include °Brix, pH, TA, berry weight, yield per vine, cluster weight, cluster number and pruning weight per vine. Collection of yield per vine and clusters per vine did not begin until 1999.

In 2001 the Heritage vineyard was harvested on 24 September. Table 2 gives an overview of the collected data. The first section of the table presents data from all Phase 1 selections. The second and third sections look at selections that were obtained from FPMS. In the second section Zinfandel imported to California from Italy, as Primitivo, is looked at individually and in the third section FPMS selections of California Zinfandel is singled out.

Yield for the 2001 harvest, measured as the mean of three vines per selection, ranged nearly 3.5 times from low to high with a high of 10.1 and a low of 3.0 kg per vine. Mean yield was of 6.4 kg per vine. Soluble Solids, measured at harvest as ° Brix, ranged from a high of 26.4 to a low of 21.2 with the mean being 23.6 ° Brix. The data show a wide range of values for most parameters.

Table 2. Zinfandel Heritage Vineyard (Phase I) 2001 harvest data.

	Yield (kg vine ⁻¹)	Cluster Per Vine	Cluster Weight (g)	Pruning Weight (kg vine ⁻¹)	Yield : Pruning Weight	Berry Weight (g berry ⁻¹)	Berry per Cluster	Soluble Solids (° Brix)	pH	TA (g l ⁻¹)
Entire Vineyard										
mean (n=61)	6.4	22	285			1.6	180	23.6	3.30	6.0
Stdev	1.5	2	58			0.2	36	1.1	0.07	0.6
High	10.1	27	420			2.1	258	26.4	3.48	7.8
Low	3.0	17	136			1.2	86	21.2	3.18	4.8
Primitivo Selections										
FPMS 03	5.4	25	215			1.7	125	26.4	3.29	6.6
FPMS 05	4.6	22	206			1.3	164	25.7	3.48	5.9
FPMS 06	5.7	26	220			1.6	136	25.3	3.33	6.0
UCD Selections										
FPMS 01A	5.6	23	248			1.5	167	22.3	3.29	5.6
FPMS 02	4.3	22	196			1.5	127	23.3	3.27	5.8
FPMS 03	4.7	23	207			1.5	140	23.5	3.39	5.1

Table 3 reports mean data inclusive of all years in the same format as Table 2. Multi-year data have a moderating influence and differences seen in a single year are often less extreme. Data in Table 3 is, for most parameters, the mean of three years and two years for a couple parameters. While the range extremes seen in Table 2 are not as large in Table 3 the data show a wide and similar range for most parameters. For us to move from a collection of selections to a series of clones we will have to see individual selections perform uniquely over time. The range shown in these parameters fuel our hope that, using the Heritage Vineyard as a base, we will be able to identify Zinfandel selections that will achieve the status of clones and play important roles in the production in Zinfandel for years into the future.

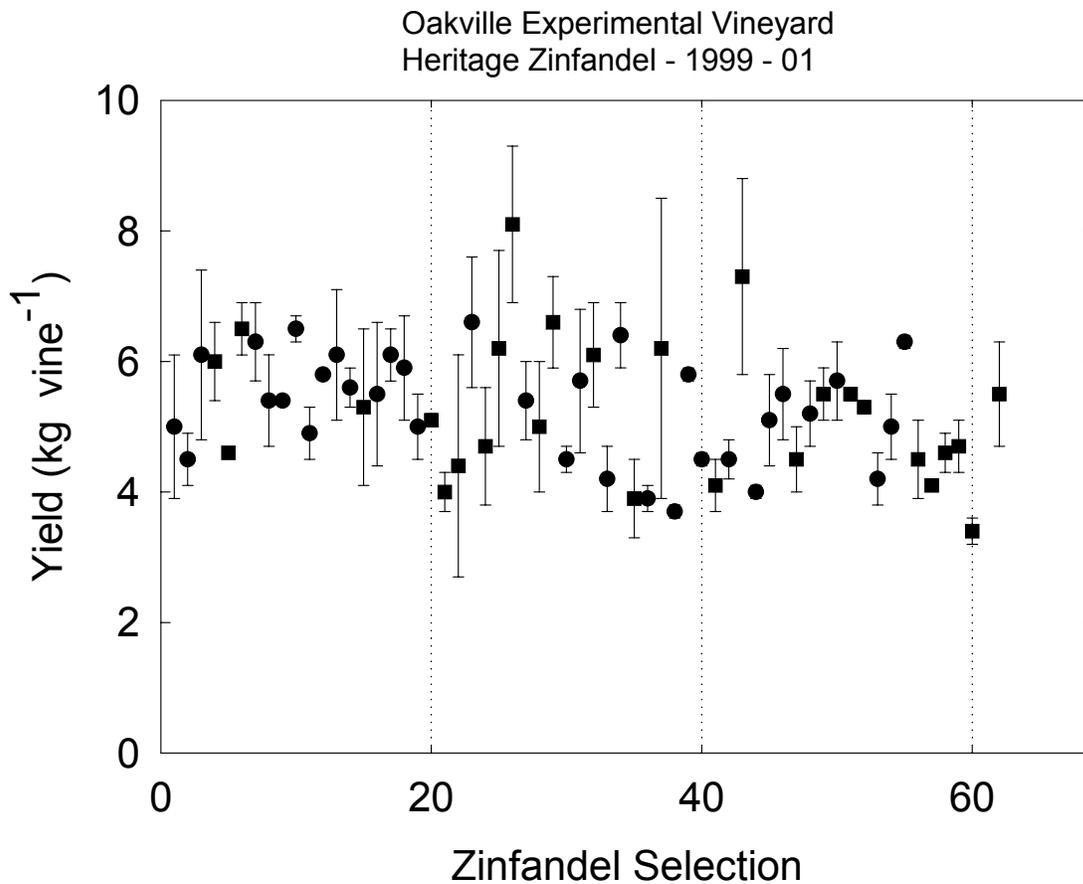
Table 3. Zinfandel Heritage Vineyard (Phase I) 1998 - 2001 harvest data (except as noted)										
	1999 - 2001	1999 - 2001	1998- 2000	1999 - 2000						
	Yield (kg vine ⁻¹)	Cluster Per Vine	Cluster Weight (g)	Pruning Weight (kg vine ⁻¹)	Yield : Pruning Weight	Berry Weight (g berry ⁻¹)	Berry per Cluster	Soluble Solids (° Brix)	pH	TA (g l ⁻¹)
<u>Entire Vineyard</u>										
mean (n=61)	5.3	21	264	1.0	4.9	1.8	146	24.1	3.27	7.2
Stdev	0.9	2	35	0.2	1.1	0.2	17	0.7	0.05	0.5
High	8.1	25	349	1.5	9.3	2.3	181	26.1	3.42	8.8
Low	3.4	18	180	0.5	2.6	1.4	106	23.0	3.19	6.1
<u>Primitivo Selections</u>										
FPMS 03	4.5	24	200	1.2	3.7	1.8	113	26.1	3.27	7.6
FPMS 05	4.1	22	180	0.7	5.7	1.4	128	25.9	3.42	6.5
FPMS 06	4.5	25	194	1.1	3.6	1.8	112	26.0	3.33	7.3
<u>UCD Selections</u>										
FPMS 01A	5.4	20	288	1.0	5.2	1.9	155	23.4	3.24	5.2
FPMS 02	4.5	22	231	0.9	5.2	1.8	129	23.4	3.22	5.2
FPMS 03	4.2	20	241	0.8	5.1	1.8	133	23.1	3.28	5.1

The Primitivo selections have their origin in Italy and therefore may represent a line of Zinfandel different from those we collected in California. When compared to the Heritage Vineyard selections as a whole, several general observations can be made. For both the 2001 data (Table 2) and the multi-year data (Table 3) the Primitivo selections all had data for yield, cluster weight, berry weight and berries per cluster that were equal to or below the mean for all selections. Indeed, for the multi-year data Primitivo FPMS 05 has both the lightest clusters and berries in the entire vineyard. Additionally, for both the 2001 and multi-year data the Primitivo selections had clusters per vine and soluble solids that were above the vineyard mean. At this point the Primitivo selections, despite having more clusters per vine, seem to have lighter yields resulting from smaller and fewer berries per cluster that ripen earlier than most of the other selections in the Heritage Vineyard. These observations have held true for several years.

The FPMS Zinfandel selections were singled out to investigate if their maligned industry reputation as large berried, large clustered over yielding selections appeared warranted. For no parameter do these selections set the high or low value for the vineyard. Nor do they fall outside the range set when looking at the mean \pm one standard deviation. In general though we can say that up to this point there is no data that distinguishes them from the Heritage selections.

Mean yield data across years show a clustering between 4 and 6 kg per vine (Figure 1). The data for some selections is quite variable as seen by the extreme length of their error bars. Among the selections with relatively small error bars we can see selections that are both on the high and low end of the group. Virus status is identified in the figure and there seems to be no correlation of virus status with either yield or variability of the data. This data suffers from the fact that it has its origin in a non-replicated vineyard. Data for the remaining viticultural data show similar patterns but will be omitted in the interest of brevity.

Figure 1. Zinfandel Heritage Vineyard - mean yield 1999 – 2001. ■ = virus positive, ● = virus negative. Data are \pm standard error of the mean.



New replicated Vineyard

We believe that we will not learn all we want about the Heritage selections without a replicated trial. Initially, the number of selections made this impossible and we hoped to choose selections to be placed in a replicated trial using viticultural data and evaluations of the wine we are making. During 2001 we planted our new replicated vineyard.

Deciding what selections to include in the replicated vineyard was a difficult task and required us to construct a logical scheme. With in the Heritage Vineyard there are some selections from the same vineyard and some of the selections have been found to contain virus. Our scheme employed these facts and included only selections that are both virus free and from unique vineyards. Using these criteria we can reduce the number of selections from 61 to 20. In the case of vineyards with multiple clean selections we arbitrarily chose one selection unless we had a winemaking history with one of the choices. All the selections with which we have a winemaking history were included in the replicated trial. The following table describes the selections used in the replicated trial. Selections with a wine making history are indicated in the table with an asterisk.

Selections for Oakville replicated Heritage Zinfandel trial

Selection	Designation
1	Contra Costa #1 *
7	Sonoma #1
10	Sonoma #4
13	Sonoma #7
16	Sonoma #18
19	Sonoma #10
23	Sonoma #14
27	UCD #1
30	UCD #2 *
31	Sonoma #16 *
33	UCD #3
36	Sonoma #27 *
38	Napa #1 *
40	UCD #4 (primitivo) *
42	UCD #6 *
44	Mendocino #2 *
48	Mendocino #6 *
50	Mendocino #8
53	Napa #3 *
55	Napa #5
total	20

The new vineyard, like the original Heritage Vineyard, is located in the Oakville Experimental Vineyard's "Old Federal" vineyard and consists of 5 replications of 18 vines occupying 2 acres. We, once again, used St. George as the rootstock. The vines are planted at a spacing of 6 x 8 and will be head trained spur pruned. We anticipate that this will produce 450 kg (1000 lb) of fruit per selection and that this will be sufficient to produce 1 barrel of wine per selection. At this writing the rootstock has been planted and the irrigation installed, we will bud the vineyard in spring 2002.

The eventual release of this material through FPMS is conditional upon woody indexing for virus. Of the selections included in the new replicated vineyard only selection 10 is currently in the FPMS pipeline for woody indexing and eventual registration. FPMS has generously offered us the opportunity to test 5 additional selections this year. We will select 5 selections from the replicated vineyard to send to FPMS and hopefully be able to send the remaining selections in the future.

This vineyard represents a commitment to Zinfandel and continued research. We believe that this project continues to expand our understanding of Zinfandel and we are excited at what will be achieved.